#982192924 ID: 88072958

QK
495
.L52
E45
1987

DISTRIBUTION, AGE STRUCTURE, AND PREDATION OF BITTERROOT MILKVETCH POPULATIONS IN LEMHI COUNTY, IDAHO

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

Joe C. Elliott, Ph.D.
Ecological Consultant

DISTRIBUTION, AGE STRUCTURE, AND PREDATION OF BITTERROOT MILKVETCH POPULATIONS IN LEMHI COUNTY, IDAHO

Contract No. ID910-CT6-036
January 1987

Submitted to:
U.S. Bureau of Land Management
Idaho State Office
3380 Americana Terrace
Boise, Idaho 83706

Submitted by:
Peter Lesica
and
Joe C. Elliott
835 Eighth Avenue
Helena, Montana 59601

TABLE OF CONTENTS

Section Page

I INTRODUCTION 1

II METHODS 3

III RESULTS 12

A. Livestock 19
B. Wildlife 23
C. Insect Seed Predators 23
D. Fungal Pathogens and Flower Abortion 25

IV SUMMARY AND MANAGEMENT RECOMMENDATIONS 27

LITERATURE CITED

LIST OF TABLES

Table		Page
1	ESTIMATED BITTERROOT MILKVETCH POPULATION SIZES AND LOCATIONS	13
2	CANOPY COVER OF VASCULAR PLANT SPECIES AT 6 BITTERROOT MILKVETCH SITES IN IDAHO AND MONTANA	14
3	SOILS ASSOCIATED WITH BITTERROOT MILKVETCH POPULATIONS . . .	15
4	SUMMARY OF POPULATION DATA FOR BITTERROOT MILKVETCH STUDY SITES	17
5	STOCKING RATES FOR BLM GRAZING ALLOTMENTS IN THE LEMHI RESOURCE AREA	22

LIST OF FIGURES

Figure | Page

1 Populations of Bitterroot Milkvetch in the Lemhi River Valley, Idaho 6

LIST OF PHOTOGRAPHS

Photograph		Page
1	BITTERROOT MILKVETCH IN FLOWER AND FRUIT	4
2	BITTERROOT MILKVETCH FRUITS	5
3	50 m TRANSECT LINE THROUGH BITTERROOT MILKVETCH POPULATION	9
4	SQUARE METER PLOT ALIGNED ALONG TRANSECT	9
5	BITTERROOT MILKVETCH GRAZED BY CATTLE	20
6	BITTERROOT MILKVETCH PODS PREDATED BY LARVAL STAGE OF SEED-EATING WEEVIL (FAMILY - CURCULIONIDAE)	24
7	BITTERROOT MILKVETCH FRUITS INFECTED WITH THE FUNGAL PATHOGEN, THECOPHORA DEFORMANS	26

I. INTRODUCTION

Bitterroot milkvetch (Astragalus scaphoides) (Jones) Rydb. is a member of the legume family (Fabaceae) found only in east-central Lemhi County, Idaho, and adjacent Beaverhead County, Montana (Barneby 1964, Lesica 1984a). Bitterroot milkvetch has recently been listed as a candidate for threatened or endangered status (Category 2) by the U.S. Fish and Wildlife Service (Miller, pers. comm., 1986). This species also is listed as recommended for the Federal Watch List in Idaho (Steele *et al*. 1981). In a 1984 study conducted by Lesica (1984b), bitterroot milkvetch was found to be rare within its restricted range in Idaho and possibly threatened by reduced reproductive output resulting from predation.

The center of distribution of bitterroot milkvetch in Lemhi County, Idaho, includes a considerable amount of federally owned land managed by the Bureau of Land Management (BLM). Because bitterroot milkvetch is listed as a candidate species for threatened or endangered status, the BLM contracted Peter Lesica and Joe Elliott to conduct field studies and to write this report. The purpose of the study was to:

1) Determine the range and habitat requirements of bitterroot milkvetch and to locate populations of the species in Lemhi County, Idaho.

2) Complete Phase I of a study to determine the impact of predation on populations of bitterroot milkvetch and determine the source(s) of the predation.

3) Establish permanent transects to monitor trends in density, age structure, and fecundity of populations of bitterroot milkvetch at selected, representative sites.

II. METHODS

Bitterroot milkvetch is a caulescent perennial species belonging to Section _Reventi-arrecti_ of the genus _Astragalus_ (Barneby 1964). Reproductive individuals are 20 to 50 centimeters (cm) high with 3 to 10 pinnately compound leaves at 3 to 9 cm intervals along the erect to nearly-erect stem (Photographs 1 and 2). The inflorescence is composed of 1 to 4 racemes in the axils of the upper leaves. Each raceme consists of a naked peduncle, 5 to 15 cm long, below a tight cluster of 10 to 30 flowers. The floriferous part of the raceme is 3 to 10 cm long, expanding to as much as 20 cm in fruit. Non-reproductive individuals generally have a basal cluster of 3 to 4 leaves and a short (less than 15 cm) sterile stem with 1 to 5 leaves. The branching caudices of reproductive individuals often bear up to 4 similar stems (see Barneby (1964) and Hitchcock _et_ _al_. (1961) for complete morphological descriptions).

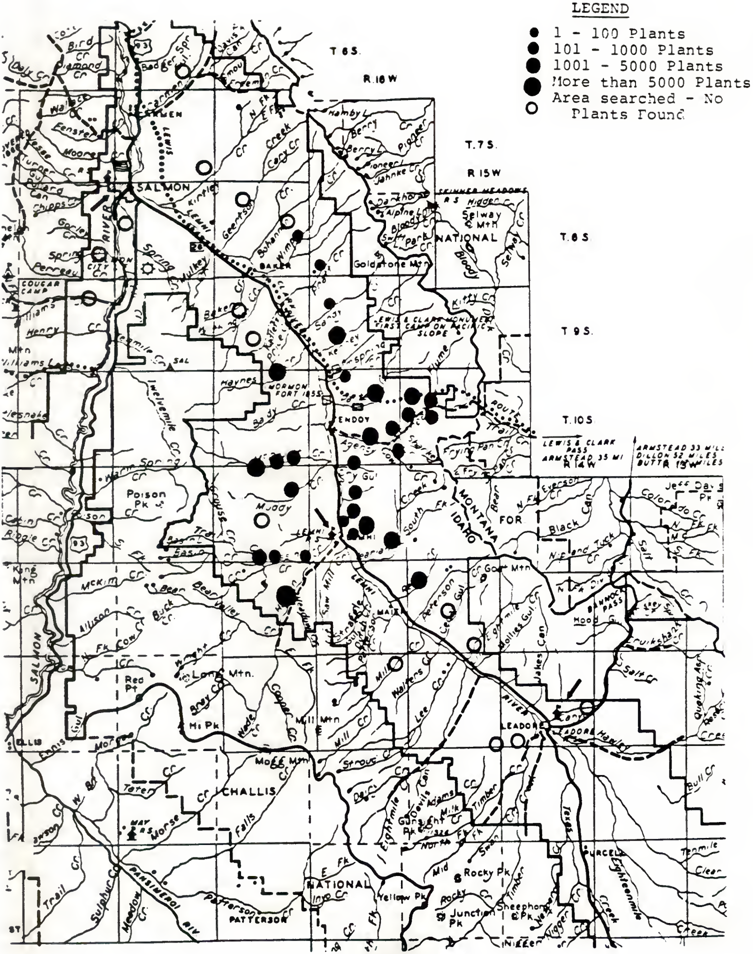
Bitterroot milkvetch generally blooms during the first 3 weeks of June and fruit matures during late June and early July. Bumblebees (_Bombus_ spp.) were the only pollinators observed visiting the flowers during this study.

Field studies were conducted June 6 through June 9, 1986 to search for bitterroot milkvetch in the Lemhi Valley from Leadore north to Salmon and in the Salmon River Valley from Carmen Creek south to Williams Creek (Figure 1). Although bitterroot milkvetch is known along the North Fork of the Salmon River near Shoup, the south side of the river was not searched because of extreme flood conditions. In a previous study conducted in this area, however, Lesica (1984a) found only one small population along the north side of the river.

The inventory was conducted by driving all secondary roads in the study area from the valley bottom up to the zone of continuous forest and by searching on foot all likely habitat (i.e., sagebrush grassland with relatively deep soils). Bitterroot milkvetch was blooming profusely during the

PHOTOGRAPH 1: BITTERROOT MILKVETCH IN FLOWER AND FRUIT

PHOTOGRAPH 2: BITTERROOT MILKVETCH FRUITS


LEGEND
● 1 - 100 Plants
● 101 - 1000 Plants
● 1001 - 5000 Plants
● More than 5000 Plants
○ Area searched - No Plants Found
T.6S.
R.16W
T.7S.
R.15W
T.8S.
T.9S.
T.10S.
R.14W
R.13W
SALMON
CARMEN
BAKER
TENDOY
LEMHI
LEADORE
CHALLIS
PATTERSON
MONTANA
IDAHO
NATIONAL
FOR
LEWIS & CLARK PASS ARMSTEAD 35 MI
ARMSTEAD 33 MILES DILLON 52 MILES BUTTE 150 MILES
BANNOCK PASS
LEWIS & CLARK MONUMENT FIRST CAMP ON PACIFIC SLOPE
MORMON FORT 1855
SKINNER MEADOWS
Goldstone Mtn
Poison Pk
Red Pt
Hi Pk
Long Mtn.
Mill Mtn
Moffett Mtn
Rocky Pk
Junction Pk
Sheephorn Pk
Yellow Pk
Goat Mtn
Jeff Davis Pk
King Mtn
Selway Mtn
SALMON RIVER
LEMHI RIVER
Salmon

time of the inventory, greatly facilitating the detection of populations. The population sizes were estimated and all locations were mapped on U.S. Geological Survey (USGS) topographic maps (1:62,500 scale).

During the period of July 4 through 7, 1986, population structure, fecundity, and predation data were recorded from 5 sites in the Lemhi Valley, Idaho, and 1 site in Montana.[1] At the sites where the density of bitterroot milkvetch was highest, 2 parallel 50-meter (m) transect lines were laid out perpendicular to the direction of the slope. The location of transects at Agency Creek, Haynes Creek, and Sheep Corral Gulch were permanent marked by driving iron rods into the ground at the start and end points.

Transects were permanently marked to allow comparative data to be collected through periodic monitoring. Data collected over a period of years can yield the following demographic parameters.

1) Percent of population which is reproductive.

2) Percent of potential reproductive output lost to predation.

3) Percent of potential reproductive output lost to abortion.

4) Mean reproductive output.

5) Average life expectancy.

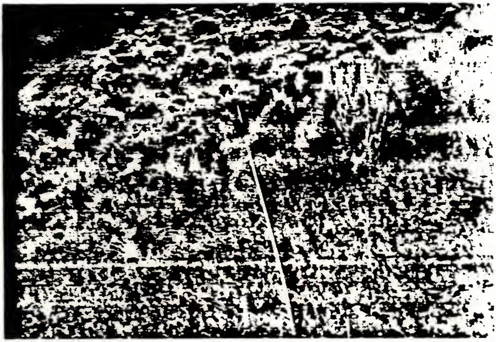
6) Age distribution.

7) Average time required for an individual to reach reproductive maturity (generation time.)

8) Average number of offspring produced by an average plant (net reproductive rate).

---

[1] Although not part of this contract, Peter Lesica collected data for a bitterroot milkvetch population in Beaverhead County, Montana.



PHOTOGRAPH 3: 50 m TRANSECT LINE THROUGH BITTERROOT MILKVETCH POPULATION

PHOTOGRAPH 4: SQUARE METER PLOT ALIGNED ALONG TRANSECT

mature plant with 2 inflorescences removed by predation and 1 intact inflorescence bearing 10 fruit would be recorded as $M\text{-}P_2F_1\text{-}10$.

At each site, 50 randomly selected, mature fruits were collected from at least 25 plants to estimate the mean number of seeds per fruit and assess the impact of predation by seed-eating insects. In every fifth plot, total canopy cover for all vascular plant species was estimated by using the following cover classes.

Coverage Class	Range	Midpoint
0	0 - 1%	0.5%
1	2 - 5%	2.5%
2	6 - 25%	15.0%
3	26 - 50%	37.5%
4	51 - 75%	62.5%
5	76 - 95%	85.0%
6	96 - 100%	97.5%

Mean canopy cover for a species is the average of the midpoints of the cover classes recorded in the 20 plots at each site. (For a more detailed description of measuring canopy coverage, refer to Daubenmire (1959).) The presence of cattle droppings, native ungulate (deer, elk, antelope, or moose) droppings, and rabbit droppings also were recorded at each plot.

At the Cow Creek, Agency Creek, Haynes Creek, and McDevitt Creek sites, small snap traps were set to obtain data on relative density of microtine and cricetine rodents. For 1 night at each site, 2 traplines, approximately 50 m long with 10 traps, were set in the vicinity of the vegetation transects. Traps were set in early evening and checked the following morning. The traps were baited with peanut butter and rolled oats.

Stomachs were removed from the trapped deer mice and meadow voles and the contents were analyzed microscopically to determine whether bitterroot milkvetch was an important dietary component. Fresh seed pods of bitterroot

III. RESULTS

Populations of bitterroot milkvetch were found on the east side of the Lemhi Valley in all secondary drainages from Reese Creek north to Bohannon Creek and on the west side of the valley from Hayden Creek north to Haynes Creek (Figure 1). The largest populations occur in the center of this range on both sides of the valley. Table 1 presents population estimates for all sites found in the study area. Bitterroot milkvetch was found to occur on moderately deep to deep loamy soils on gentle to moderate slopes, generally with a warm aspect. In the center of its range in the Lemhi Valley, bitterroot milkvetch is found on all slope positions, while at the periphery of this range, it is confined to toeslopes and terraces along drainages. Populations range in elevation from 4,800 to 6,800 feet. The most common associated species are big sagebrush (_Artemisia_ _tridentata_)[2] and bluebunch wheatgrass (_Agropryon_ _spicatum_). Other common associated species are three-tipped sagebrush (_A_. _tripartita_), cheatgrass (_Bromus_ _tectorum_), Sandberg's bluegrass (_Poa_ _sandbergii_), and lupine (_Lupinus_ sp.) (see Table 2).

Although bitterroot milkvetch does not appear to be associated with any specific soil series, its distribution is correlated with soil texture, aspect, and soil drainage characteristics (see Table 3). Nearly all populations of the plant occur on brown loamy, well drained soils with cobbles or gravel, with south or west exposure.

Life history, population, fecundity, and predation data for 5 bitterroot milkvetch sites in Idaho and 1 site in Montana are presented in Table 4. Densities of bitterroot milkvetch plants at the 6 sites are not high,

---

[2] Bitterroot milkvetch occurs with both _Artemisia_ _tridentata_ ssp. tridentata and _Artemisia_ _tridentata_ ssp. vaseyana.

TABLE 1

ESTIMATED BITTERROOT MILKVETCH
POPULATION SIZES AND LOCATIONS

Location	Name	Number of Plants	Acreage
T21N R23E Sec. 24	Wimpy Creek	1 - 100	15
T21N R24E Sec. 31 & 32	Pratt Creek	1 - 100	15
T20N R24E Sec. 10	Sandy Creek	1 - 100	15
T20N R24E Sec. 21	Kenny Creek	1001 - 5000	20
T19N R24E Sec. 4	Warm Springs Creek	1 - 100	5
T19N R23E Sec. 2 & 3	Haynes Creek	1001 - 5000	45
T19N R24E Sec. 11	Pattee Creek	1001 - 5000	40
T19N R24E Sec. 26 & 27	Agency Creek	1001 - 5000	60
T19N R24E Sec. 25	Agency Creek	101 - 1000	15
T19N R25E Sec. 19	Agency Creek	101 - 1000	20
T19N R25E Sec. 18	Agency Creek	1001 - 5000	60
T19N R25E Sec. 17	Agency Creek	101 - 1000	30
T19N R25E Sec. 19	White Creek	101 - 1000	20
T19N R25E Sec. 25	Cow Creek	101 - 1000	25
T18N R24E Sec. 3	Big Dry Gulch	101 - 1000	30
T18N R24E Sec. 16	Little Dry Gulch	101 - 1000	25
T18N R24E Sec. 22	Napo Canyon	101 - 1000	25
T18N R24E Sec. 21	Mile 30	1 - 100	20
T18N R24E Sec. 27	Ramsey Mountain	1001 - 5000	60
T18N R24E Sec. 27	Lemhi	101 - 1000	30
T18N R24E Sec. 25	Yearian Creek	1001 - 5000	60
T17N R25E Sec. 7	Reese Creek	1001 - 5000	30
T17N R23E Sec. 22	Hayden Creek	5000+	155
T18N R23E Sec. 33	Basin Creek	101 - 1000	15
T18N R23E Sec. 34	Basin Creek	1 - 100	5
T17N R23E Sec. 1	Basin Creek	1 - 100	10
T18N R23E Sec. 14	Muddy Creek	101 - 1000	20
T18N R23E Sec. 3	McDevitt Creek	1001 - 5000	80
T19N R23E Sec. 35	McDevitt Creek	101 - 1000	30
T19N R23E Sec. 36	McDevitt Creek	101 - 1000	5

TABLE 2
CANOPY COVER* OF VASCULAR PLANT SPECIES AT 6 BITTERROOT MILKVETCH SITES IN IDAHO AND MONTANA

Species	Agency Creek	Cow Creek	Hayden Creek	Haynes Creek	McDevitt Creek	Sheep Corral
Bare ground	55	18	47	36	23	48
Rock	--	29	14	24	7	27
Litter	45	48	38	35	63	16
Total Plant	86	103	77	95	138	70
Shrubs						
Artemisia tridentata	1	13	--	8	3	27
Artemisia tripartita	12	P	39	--	2	--
Chrysothamnus nauseosus	2	1	2	--	--	P
Chrysothamnus viscid.	3	--	--	--	11	2
Grasses						
Agropyron smithii	31	--	--	--	--	--
Agropyron spicatum	5	33	15	17	11	15
Agropyron caninum	--	--	--	8	--	--
Bromus tectorum	P	41	4	49	60	--
Festuca octoflora	--	--	--	--	3	--
Poa sandbergii	10	9	5	--	20	P
Stipa comata	10	--	--	--	9	2
Stipa occidentalis	8	--	--	--	--	--
Forbs						
Antennaria microphylla	--	--	4	--	--	--
Artemisia frigida	1	P	P	--	--	--
Aster scopulorum	--	--	P	--	--	5
Astragalus miser	--	--	3	--	--	P
Astragalus scaphoides	P	P	2	1	2	2
Balsamorhiza sagittata	--	--	--	2	--	--
Comandra umbellata	--	--	--	2	--	--
Cordylanthus ramosus	--	--	--	--	--	3
Erigeron pumilus	P	P	P	P	1	--
Eriogonum strictum	--	P	--	P	3	--
Gutierrezia sarothrae	--	--	--	--	--	2
Leptodactylon pungens	--	--	--	--	--	2
Lupinus sp.	--	1	--	4	8	--
Opuntia polyacantha	P	--	--	--	2	2
Phacelia linearis	P	P	1	--	P	--
Phlox hoodii	--	--	--	--	--	4
Phlox longifolia	P	1	1	P	2	P

*Only species with cover >1 percent at 1 site are included. P indicates cover less than 1 percent. Total plant cover is the sum of the estimated percent coverage for all species present. Nomenclature follows Hitchcock and Cronquist (1973).

TABLE 3

SOILS ASSOCIATED WITH BITTERROOT MILKVETCH POPULATIONS

Population Location	Soil Series	Soil Texture	Location	Drainage Class
Hayden Creek (Section 22)	Dacore-Zeebar Association	Brown gravelly loam	South and west facing slopes	Well drained
Basin Creek (Section 33)	Cronks-Accord Association	Brown cobbly loam	South and west facing slopes	Well drained
Basin Creek (Section 34)	Millhi-Lacrol Complex	Brown gravelly silt loam	South and west facing slopes	Moderately well drained
Basin Creek Sections 35 & 36)	Orthids Complex	Pale brown, very gravelly loam	South and west facing slopes	Well drained
Reese Creek (Sections 7 & 8)	Zer Series	Light yellowish brown, very cobbly loam	South and west facing slopes	Well drained
Yearian Creek (Section 25)	Orthids Complex	Pale brown, very gravelly loam	South and west facing slopes	Well drained
Lemhi (Section 27)	Dawtonia and Dawtonia-Custco Association	Brown gravelly loam	Fan terraces	Well drained
Haynes Creek (Sections 2 & 3)	Cronks-Accord Association	Brown cobbly loam	South and west facing slopes	Well drained
Warm Springs Creek (Section 34)	Dawtonia-Custco Association	Brown gravelly loam	Fan terraces	Well drained
Kenney Creek (Section 21)	Dawtonia-Custco Association	Brown gravelly loam	Fan terraces	Well drained
Sandy Creek (Section 10)	Povey-Klug Association	Brown, very gravelly loam	Mountain sides	Well drained
Pratt Creek (Sections 31 & 32)	Cryoborolls	Dark brown, stoney loam	Mountain sides	Well drained

TABLE 4

SUMMARY OF POPULATION DATA FOR BITTERROOT MILKVETCH SITES

Population Characteristics	Agency Creek	Cow Creek	Hayden Creek	Haynes Creek	McDevitt Creek	Sheep Corral
Population Density (Plants/100 m^2)	23	21	74	53	19	128
Percent Seedlings	0	14	22	25	16	28
Percent Non-reproductive	0	10	32	24	10	33
Percent Mature	100	76	46	51	74	39
Inflorescences/100 m^2	90	80	175	105	102	126
Percent Aborted Inflorescences	--	19	24	30	38	19
Percent Predated Inflorescences	100	36	15	47	1	19
Percent Fruiting Inflorescences	0	45	61	23	61	62
Percent Mature Plants with Predated Inflorescences	100	38	29	78	7	26
Percent Mature Plants Producing Fruit	0	69	85	52	86	64
Mean Number of Fruit per Intact Inflorescence	--	5.2	6.4	5.5	5.2	5.1
Mean Number of Seeds per Unpredated Fruit	--	12.3	14.3	14.4	13.7	15.0
Percent Fruits with Insect Predation	--	6	10	4	0	32
Mean Number of Seeds per Predated Fruit	--	2.7	1.4	4.0	--	3.6
Percent of Quadrats with Cattle Droppings	49	11	10*	13	35*	4

ranging from 0.2 to 0.7 plants per m^2. The mean number of fruits per intact inflorescence ranges from 5.1 to 6.4, and is not significantly different between any of the populations (one-way analysis of variance (ANOVA), $p>0.40$). The mean number of seeds per unpredated fruit ranges from 12.3 to 15.0. Although the values are similar, the Cow Creek population mean is lower than the means for the Haynes Creek, Hayden Creek, and Sheep Corral Gulch populations (one-way ANOVA, $p<0.05$).

Our observations and data indicate that there are 3 significant sources of predation on plants of bitterroot milkvetch--livestock, wildlife, and insect seed predators. The following sections briefly describe the observations made relative to these 3 sources of predation.

A. Livestock

The only livestock observed at any of the bitterroot milkvetch sites were cattle. In early June, bitterroot milkvetch plants were observed which had stems chewed off near ground level (Photograph 5) in close proximity to fresh cow dung and cattle hoof prints. The presence of ungrazed, highly palatable grasses (e.g., bluebunch wheatgrass) near these predated milkvetch plants indicates that during flowering, the legume is a preferred food for cattle. The flower heads of white locoweed (Oxytropsis sericea) have been shown to be a preferred food of cattle in northern Utah (Ralphs et al. 1986). This preference was attributed to the high protein content and addictive effect of alkaloids present in the legume. Since Astragalus is a genus closely related to Oxytropsis and is known to possess alkaloids and high protein content (Barneby 1964), the same factors may be causing livestock preference for bitterroot milkvetch.

In general, cattle are grazed on BLM allotments from early June through September or October. Based on data from the BLM in Salmon, Idaho, the

PHOTOGRAPH 5: BITTERROOT MILKVETCH GRAZED BY CATTLE

stocking rates for the various grazing allotments are presented in Table 5. The range condition for these allotments is fair to good.

The range condition and stocking rates of the grazing allotments do not indicate overgrazing; however, heavy grazing on sites with populations of bitterroot milkvetch does occur due to livestock distribution patterns.

Bitterroot milkvetch occurs on lower slopes which are often adjacent to water and access roads; therefore, livestock grazing pressure is higher than on other areas of the allotments. Cattle typically move to and from water and congregate in and near the riparian zone. Unless the forage resource is depleted or the animals are herded or move to salting sites, the livestock tend to remain in areas of prime milkvetch habitat.

In addition, the cattle are often herded along the lower slopes adjacent to roads when moved onto the allotments in the spring and early summer. In some cases, the cattle are hauled onto the allotment and released directly onto bitterroot milkvetch populations.

Cattle use of the Agency Creek site was heavy in 1986, as evidenced by the large number of cattle and cattle dung present (Table 4). All bitterroot milkvetch inflorescences in the transects were destroyed by predation (i.e., cattle grazing), and no seedlings were observed (Table 4).

The McDevitt Creek site also had a relatively large number of cattle droppings and a low percentage of seedlings (Table 2). Inflorescence predation was low in 1986; however, because the cattle droppings appeared to be from the previous year, predation may have been greater in previous years. The inverse relationship between the presence of cattle and the presence of seedlings at the McDevitt Creek and Agency Creek sites indicates that livestock grazing may be having an adverse effect on the age structure and consequently on the long-term vigor and fecundity of bitterroot milkvetch populations.

TABLE 5

STOCKING RATES FOR BLM GRAZING ALLOTMENTS IN THE LEMHI RESOURCE AREA

Allotment	Acreage	Active Preference AUMs	Acres/AUM
Pratt Creek	4,402	747	5.9
Pronghorn Creek	771	286	2.3
Haynes Creek	10,077	1,366	7.4
McDevitt Creek	14,633	2,203	6.6
Grouse Creek	18,333	2,206	8.3
Sandy Creek	4,245	483	8.9
Kinney Creek	870	144	6.0
Warm Springs	6,619	2,250	2.9
Pattee Creek*	5,381	998	5.4
Squaw Creek	7,777	1,510	5.1
Napo Canyon	5,335	573	9.3
Yearian Creek	26,258	3,494	10.5

*This allotment includes the Agency Creek bitterroot milkvetch population.

B. Wildlife

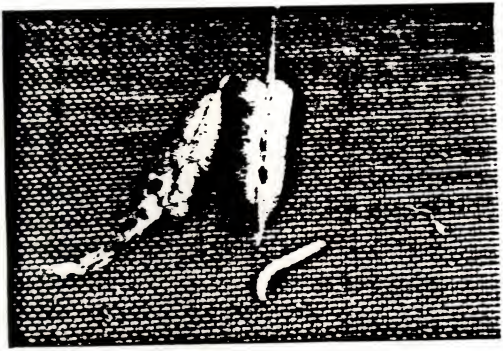
Trapping data indicate a high density of rodents at the Haynes Creek site (Table 4). Predation at this site was primarily the removal of flowering scapes just below the inflorescences. This site had the second highest predation level (percent predated inflorescences) of the 6 sites, indicating that predation by rodents may be significant in areas of high rodent density.

Microscopic analysis of the stomach contents of deer mice (Peromyscas) and meadow voles (Microtis) revealed that both of these species were foraging almost exclusively on vegetation at the time of sampling. Portions of the plant material in the stomach contents appeared to be the fleshy seed pod walls of bitterroot milkvetch. The cell structure of portions of the finely chewed stomach materials appeared to be identical with finely macerated fresh pods of bitterroot milkvetch, prepared for comparative purposes. Other portions of the stomach contents included plant material that was definitely from plants other than bitterroot milkvetch. Distinctive trichomes and portions of immature seeds were positively identified as coming from plants other than bitterroot milkvetch.

None of the sites studied had high levels of native ungulate grazing pressure as evidence by the small number of droppings observed in the transects (Table 2). Rabbit droppings were observed only at the Sheep Corral Gulch site, where the number of predated inflorescences was relatively low (Table 2).

C. Insect Seed Predators

At 4 sites, we observed small grubs in the fruits of bitterroot milkvetch (Photograph 6). These insects have been tentatively identified as the larval stage of seed-eating weevils in the family Curculionidae (Liebherr, pers. comm., 1986). The presence of a weevil grub lowered the mean number of mature seeds per fruit by 72 to 90 percent; however, only the Sheep Corral



PHOTOGRAPH 6: BITTERROOT MILKVETCH PODS PREDATED BY LARVAL STAGE OF SEED-EATING WEEVIL (FAMILY - CURCULIONIDAE)

Gulch site had levels of insect fruit predation greater than 10 percent (Table 4). Although insect predation reduced seed output by approximately 25 percent at Sheep Corral ~~Coral~~ Gulch, the number of seedlings present was higher than at any other site (Table 4). This finding indicates that even relatively high levels of insect seed predation do not necessarily cause reductions in recruitment. Evidence of insect herbivory was observed on the foliage of many plants, but the extent of the damage was minor in most cases.

D. Fungal Pathogens and Flower Abortion

In addition to the previously mentioned sources of predation, bitterroot milkvetch plants which had been attacked by a smut fungi were occasionally observed. These plants exhibited smaller, somewhat wrinkled fruits filled with fine black spores instead of seeds (Photograph 7). This smut, which was uncommon in 1986, has been tentatively identified as *Thecaphora deformans* (Duggan, pers. comm., 1986).

Populations of bitterroot milkvetch had 19 to 38 percent aborted inflorescences (Table 4). Predispersal abortion may be the result of pollination failure, resource deficiencies, or genetically determined developmental failures (Fenner 1985). Abortion rates similar to those displayed by bitterroot milkvetch in this study are not uncommon (Stephenson 1981). The effects of this flower abortion on the population dynamics of bitterroot milkvetch are unknown. The McDevitt Creek population, which had the lowest level of predation, had the highest level of inflorescence abortion (Table 4). Lower abortion rates may be a compensatory response by the plant to predation.

PHOTOGRAPH 7: BITTERROOT MILKVETCH FRUITS INFECTED WITH THE FUNGAL PATHOGEN, *THEOPHORA DEFORMANS*

IV. SUMMARY AND MANAGEMENT RECOMMENDATIONS

Bitterroot milkvetch is endemic to a small area of east-central Lemhi County, Idaho, and adjacent Beaverhead County, Montana. It is fairly common in the center of its range in Idaho, but decreases in abundance and frequency with increasing distance from the center of its range.

High levels of inflorescence predation on bitterroot milkvetch are associated with intense cattle grazing pressure (Agency Creek) and high rodent densities (Haynes Creek). At Agency Creek, the almost complete destruction of all inflorescences is associated with the absence of seedlings, indicating that prolonged, intense grazing pressure is probably capable of causing the extinction of populations. The results of the study indicate that, in areas of light to moderate livestock grazing, bitterroot milkvetch is capable of maintaining healthy, viable populations. Although insect seed predation is common in some areas, its effects are not readily apparent.

Bitterroot milkvetch may be too abundant to be considered threatened or endangered in Idaho at this time; however, its very limited distribution and susceptibility to livestock grazing dictate the necessity of special management considerations and long-term monitoring.

Many large populations of bitterroot milkvetch occur on toeslopes and terraces adjacent to streams. The gentle slopes and proximity to water associated with these areas make them particularly prone to heavy livestock utilization. Whenever possible, these areas should be deferred from grazing during the first 3 weeks in June when bitterroot milkvetch is most susceptible to foraging livestock. Stocking rates should be lowered on grazing allotments which contain large populations of bitterroot milkvetch and which show a downward trend in range condition. When cattle are first introduced to BLM grazing allotments in the early summer, the cattle should be released at sites view of the documented vulnerability to natural and human-induced impacts, it is recommended that the next phase of the study be conducting during the summer of 1987.

LITERATURE CITED

LITERATURE CITED

Barneby, R.C. 1964. Atlas of North American Astragalus, Parts 1 and 2. Mem. New York Bot. Gard. 13:1-1188.

Daubenmire, R. 1959. A Canopy-cover Method of Vegetational Analysis. Northw. Sci. 33:43-64.

Duggan, Frank. 1986. School of Forestry, University of Montana, Missoula, Montana. Personal communication (September 1986) with Peter Lesica, Botanist, Missoula, Montana.

Fenner, M. 1985. Seed Ecology. Outline Studies in Ecology. Chapman and Hall, New York. 151+ pp.

Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. Seattle: University of Washington Press. 730 pp.

Lesica, P. 1984a. Report on the Conservation Status of Astragalus scaphoides, a Candidate Species. Report submitted to the U.S. Fish and Wildlife Service, Denver, Colorado.

Lesica, P. 1984b. The Distribution and Reproduction Effort of the Rare Plant Astragalus scaphoides in Montana and Idaho. Report submitted to The Nature Conservancy, Montana/Wyoming Office, Helena, Montana.

Liebherr, James. 1986. Curator of the Coleoptera Collection, Comstock Entomology Museum, Cornell University, Ithaca, New York. Personal communication (September 1986) with Peter Lesica, Botanist, Missoula, Montana.

Miller, James. 1986. U.S. Fish and Wildlife Serivce, Office of Endangered Species, Denver, Colorado. Personal communication (January 1986) with J. Stephen Shelly, The National Heritage Program, Helena, Montana.

Steele, R.S., S.J. Brunsfeld, D.M. Henderson, K.E. Holte, F.D. Johnson, and P.L. Packard. 1981. Vascular Plant Species of Concern in Idaho. University of Idaho Forest, Wildlife and Range Experiment Station, Bull. 34. 161 pp.

Stephenson, A.G. 1981. Flower and Fruit Abortion Proximate Causes and Ultimate Functions. Ann. Rev. Ecol. Syst. 12:253-279.

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225